tive risk models were built using risk scores based on regression β values. Cox regression entering only traditional factors showed that age (risk scores: <60 years = 0, 60-64 years = 1, 65-69 years = 2, 70-79 years = 5, ≥80 years = 8), diabetes (yes = 1), congestive heart failure (yes = 2), LV ejection fraction (≥65% = 0, 41-64% = 1, ≤40% = 4), number of severe coronaries (1 = 0, 2-3 = 1), and treatment type (revascularization = 0, medical treatment = 1) predicted mortality (ROC area: 0.733 for the risk factor sum, 0.747 for categorical variables). CRP (<1.0 mg/dL = 0, 1.0-1.99 mg/dL = 2, 2.0-4.99 mg/dL = 4, ≥5.0 mg/dL = 5), CMV (seropositive = 2), and HCY (≥16 μmol/L = 1) were each significant, independent predictors of mortality, and the full risk model including traditional and novel factors improved ROC areas to 0.764 (risk sum) and 0.777 (categories).
Conclusions: The Intermountain Risk Model provides an excellent assessment of mortality risk for patients with existing CAD; further, addition of novel risk factors (CRP, CMV, HCY) increases the accuracy of the risk model. The Intermountain Risk Model may provide an enhanced ability to evaluate risk of mortality and guide therapy in CAD patients.

3:00 p.m.

827-5 **Economic Consequences of Routine Coronary Angiography in Low-Risk Patients With Unstable Angina**

Akshay S. Desai, Daniel H. Solomon, Peter H. Stone, Christopher P. Cannon, Jerry Avorn, *Brigham and Women's Hospital, Boston, Massachusetts.*

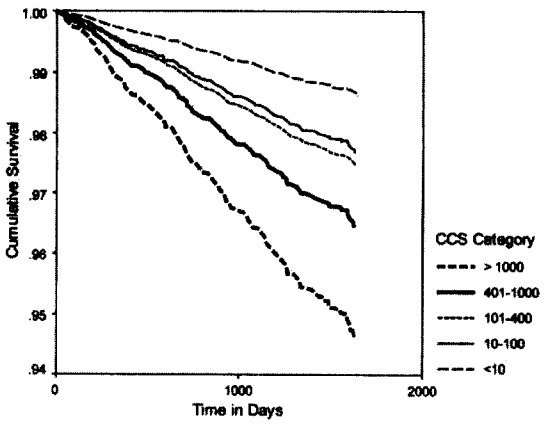
BACKGROUND: In low-risk patients with unstable angina and non-ST elevation myocardial infarction (UA/NSTEMI), early invasive management with coronary angiography does not reduce the risk of death or MI. Yet, such patients are often managed invasively. The economic consequences of an invasive management strategy in low-risk patients are unknown.
METHODS: A risk prediction rule was applied to a multi-hospital clinical case database and to the trial population of Thrombolysis in Myocardial Ischemia IIIB (TIMI IIIB), which compared early invasive to conservative therapy for UA/NSTEMI. The effect of the early invasive strategy was analyzed with regard to the composite endpoint of death, MI, or rehospitalization (rehosp) for rest ischemia at 42 days and at 1 year using a logistic regression model in patients with high and low risk scores. Costs and benefits of early invasive management of low-risk patients were assessed using 1999 Medicare reimbursement data.
RESULTS: In our case database, 56.5% of low-risk patients with UA/NSTEMI underwent early cardiac catheterization. In TIMI IIIB, early invasive management of low-risk patients with unstable angina was associated with no difference in the rate of death or MI relative to medical therapy. However, when rehosp was added to the composite endpoint, invasive management was superior to conservative management at both 42 days (P=.005) and at 1 year (P=0.03) in all risk groups. Thus, 5.4% of rehospitalizations in low-risk, conservatively managed patients would have been avoided had they been treated instead with an early invasive strategy. Within TIMI IIIB, this amounts to 40 fewer rehospitalizations at an additional cost of $2,668,200 to $6,921,400. This expenditure of $66,700 to $173,000 per hospitalization prevented far exceeds the monetary cost of rehospitalization ($13,200).
CONCLUSIONS: Although common in clinical practice, routine early invasive management of low-risk patients with unstable angina generates significant health care costs without mortality benefit. Unless the incremental benefit in quality of life from prevented hospitalizations is judged to be worth the large incremental cost, such a strategy is unlikely to be cost-effective.

3:15 p.m.

827-6 **Risk-Adjusted Mortality by Extent of Coronary Calcification**

Tracy Q. Callister, Enrique F. Schisterman, Daniel Berman, Paolo Raggi, Leslee J. Shaw, *EBT Research Foundation, Nashville, Tennessee, Tulane University, New Orleans, Louisiana.*

Background: Preliminary evidence in small observational datasets suggests that there is an association of cardiac events and coronary calcium scores (CCS). Despite this promising evidence, few data exist using risk-adjusted multivariable models to predict death as the sole primary endpoint as a function of CCS.
Methods: A cohort of 10,377 asymptomatic individuals were screened for CCS with electron beam tomography (EBT). The prevalence of cardiac risk factors were as follows: family history of CAD 69%, hypercholesterolemia 62%, hypertension 44%, current smoking 40%, and diabetes 9%. CCS was categorized into the following: 1000. Multivariable Cox proportional hazard models were developed to predict all-cause mortality. Risk-adjusted models incorporated all traditional risk factors for CAD, i.e. age, gender, hypertension, family history of CAD, diabetes mellitus, hypercholesterolemia, current cigarette smoking. Total mortality was determined by the National Death Index. During an average follow-up of 5.0+3.5 years, 249 deaths (2.4%) were reported.
Results: In a risk-adjusted model CCS was an independent predictor of mortality (c2=36.6, p<0.00001). The incremental value of CCS (defined as % D model c2) was 42.7% reflecting the amount of new predictive information contained within the CCS. Adjusted relative risks for CCS were 1.64 (p=0.01), 1.74 (p=0.008), 2.54 (p<0.00001), and 4.03 (p1000 respectively, with the <10 as the reference category. Figure 1. shows risk-adjusted survival curves: 5 year survival was 99% for those with a calcium score <10 but only 95% for those with a calcium score >1000.
Conclusion: This observational cohort study reveals that CCS is an independent predictor of mortality. These findings suggest that CCS may play a role in risk stratification, which would help guide risk-reducing strategies for the treatment of coronary atherosclerotic disease.



POSTER SESSION

1143 Assessment and Outcome in Cardiovascular Diseases

Monday, March 18, 2002, 3:00 p.m.-5:00 p.m.
Georgia World Congress Center, Hall G
Presentation Hour: 4:00 p.m.-5:00 p.m.

1143-163 **Comparison of Early Dobutamine Stress Echocardiography, Exercise Treadmill Testing, and Hospital Admission for Management of Patients Presenting to the Emergency Department With Chest Pain: A Multicenter International Randomized Study**

Luigi P. Badano, Nizal Sarraf-Zadegan, Mara Baldassi, Giorgio Scaffidi, Apostolos Karavidas, Vitas Vysniauskas, Baris Ilerigelen, Costantino Astarita, Gianni Pettinati, Alessandro Desideri, Marco Ghidina, Dario Gregori, Paolo M. Fioretti, *on behalf of the ASSENCE Investigators, IRCAB Foundation, Udine, Italy.*

Background. Management of patients presenting to emergency department (ED) with chest pain (CP) suggestive of acute coronary syndrome remains a continuing challenge, and these pts are often admitted to rule out acute myocardial infarction (AMI) and prevent sudden death. To reduce unnecessary admissions, maintain pt safety, and enhance cost-effectiveness, several strategies have been applied to the management of pts with CP. However, efficacy and safety of these strategies have never been compared in a randomized study. We conducted our study to compare safety and cost-effectiveness of dobutamine stress echocardiography (DSE) or exercise treadmill testing (ETT) versus hospital admission.
Methods. This was a randomized, prospective, international study of ED pts with CP over age 30, with no prior cardiac history, normal CK-MB and cardiac troponin, a non ischemic EKG at 6 hours from ED presentation and who were to be admitted. Pts were randomised to immediate DSE or ETT, or admission. Pts with normal DSE or ETT were discharged. Follow-up was at 1 week, 1 month and 2 months. End-points were defined as AMI, sudden death, angina requiring admission, need for revascularization, re-hospitalization for CP, in-hospital length-of-stay, hospital charges.
Results. Three hundred ten pts were enrolled in 7 participating centers, 126 in the DSE group, 89 in the ETT group and 95 in the admitted group. There was no difference in age, gender, clinical characteristics of CP, or risk factors among the 3 pt groups. There were 6 in-hospital events (1.9%): 4 AMI (3 in the admitted pt group and 1 in the DSE group), and 2 PTCA (1 in the admitted group and 1 in the DSE group). Ischemic origin of CP was diagnosed in 38% of the study population. Eighty-seven (69%) pts were discharged after DSE, and 85 (89%) were discharged after ETT (p<0.001). None of the pts discharged after DSE or ETT suffered a late event. In-hospital length-of-stay was 26±8 hours in DSE pts, 26±4 hours in ETT pts, and 72±11 hours in admitted patients (p<0.0001).
Conclusions. Early DSE or ETT in ED pts with CP, normal CK-MB, troponin and EKG at 6 hours is safe, has an equivalent predictive value for cadiac events and is less expensive as compared to hospital admission

1143-164 **Impact of an Initial Diagnostic Test on Subsequent Risk Stratification for Patients With Multiple ED Visits for Chest Pain**

Robert L. Jesse, Stephen G. Phillips, Michael C. Kontos, Charlotte S. Roberts, Shantaram Rangappa, Joseph P. Ornato, James L. Tatum, *Virginia Commonwealth University Health System / Medical College of Virginia, Richmond, Virginia.*

BACKGROUND: Chest pain (CP) accounts for 5-8 million Emergency Department (ED) visits each year. We noted that a large proportion of CP patients (pts) had multiple visits, and were often triaged to a higher risk level on subsequent visits without obvious clinical indication. This study examines whether the diagnostic modality used to exclude coronary artery disease (CAD) during any one visit influenced decision making during subsequent ED visits for these pts.
METHODS: A retrospective analysis for multiple visits via a previously validated robust CP database, was performed on all ED CP pts from 6/94 to 7/01. Recidivism was defined as 2 or more ED visits during any 6 month period. Pts were triaged to one of 4 risk levels in the

ED according to institutional protocol. Triage level assignment for each ED visit was compared relative to the diagnostic test done on the previous visit. Only patients who had CAD excluded across all visits were considered in this analysis
RESULTS: Of the 19,875 ED visits for CP, 6,653 (34% of all such visits) were by pts with at least 2 visits, including 5,977 (90%) which met the criteria for recidivism. These were attributable to 1,385 pts (9% of unique pts), 892 with CAD and 493 with no evidence of CAD. There was a mean of 4.7 visits/pt for those with and 3.6 visits/pt for those without CAD. Recidivist pts without CAD were less likely than those with CAD to have HTN (60% vs 78%), diabetes (25% vs 39%), or dyslipidemia (29% vs 68%). For pts without CAD, those who had a negative catheterization compared to those with a negative stress-imaging study or no diagnostic test performed on any given visit were less likely to be risk stratified at a higher level on the subsequent visit; 12% cath, vs 28% stress or 25% neither. These proportions were similar when comparing visit-2 to visit-1 or visit-3 to visit-2. Risk level was rarely changed at any presenation beyond visit-3.
CONCLUSIONS: 10% of CP pts account for approximately 1/3 of all ED CP visits. This is frequently associated with risk stratification to a higher level on subsequent visits. Negative catheterization appears to have a greater influence on subsequent decision making in non-CAD pts than negative stress-imaging or having no diagnostic test performed.

1143-165 Low Cost Tele-Echocardiography in an Urban/Suburban Environment

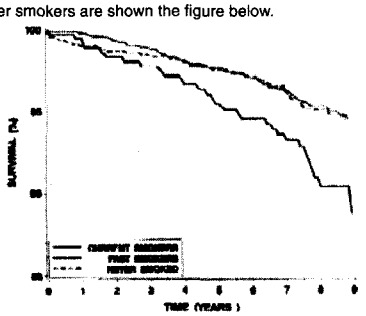
Aparna Kulkarni, M. Victoria Tantengco, Michael Pettersen, Tajinder P. Singh, Richard Humes, *Children's Hospital of Michigan, Detroit, Michigan.*

Background: The utility of tele-echocardiography (TEL) is obvious as distances increase and access to specialty care decreases, particularly in rural areas. Yet, TEL comes at a cost of equipment and services.
Objective: To compare the time and cost effectiveness of low-cost real time (384 Kbps, ISDN) TEL with on-site(ONS) echocardiography in an urban/suburban environment where travel distances are not great.
Methods: Time activity data were collected over a period of 5 months from cardiologists at Children's Hospital of Michigan(CHM), traveling from CHM to other hospitals to review echoes ONS. Recordings included travel time, time spent in the facility to review ONS and the total miles in travel. Similar measurements were obtained from cardiologists when they were reviewing echoes via TEL. Costs included telemedicine equipment ($8000), physician time ($60/hr), telephone line charges ($1200/site/yr) and mileage charges ($0.325/mi).
Results: 138 Echoes were interpreted over 5 months of ONS echocardiography during the time study. 41.74 (+/-29.1)minutes were spent per echo, in addition to 22.5 (+/-10.7) minutes of travel time with an average commute of 12.5 (+/-6.5) miles per echo. Thirty-six echoes were interpreted via TEL over a period of 3 weeks. Each echo required 14.77 (+/-4.3) min. The physician time spent for ONS vs. TEL was significantly longer ($p<0.0001$). The cost of TEL equipment was compared to the cost of travelling for every ECHO performed. ONS interpretation of ECHO costs $65.10/ECHO, compared to $14.80/ ECHO for TEL. Based on a 3-year amortization of fixed cost, costs for ONS exceed those for TEL when the transmitting site is more than 3.5 miles from the hub center.
Conclusion: Low cost telemedicine provides a cost-effective alternative to physician travel and on site presence, even in a close urban setting.

1143-166 Smoking Cessation and the Risk of Sudden Cardiac Death In Patients With Coronary Heart Disease

Ilan Goldenberg, Michael Jonas, Alexander Tennenbaum, Valentina Boyco, Avraham Shotan, Solomon Behar, Henrietta Reicher-Reiss, *Sheba Medical Center, Tel Hashomer, Israel.*

Background: Cigarette smoking is a known risk factor for sudden cardiac death (SCD). However, the effect of smoking status on SCD risk in patients with established coronary heart disease (CHD) remains controversial.
Methods: We prospectively studied 3122 patients with a previous myocardial infarction or stable angina over a mean follow-up period of 7 years - 370 patients were active smokers at randomization and throughout the study period; 1821 patients had quit smoking before or during the follow-up period; 931 patients had never smoked. The rate of SCD was determined according to smoking status.
Results: In current smokers 30 sudden coronary deaths occurred (8.1%), whereas 83 sudden coronary deaths occurred in patients who had quit smoking (4.6%) and 43 patients who had never smoked died suddenly (4.6%, p=0.014). In multivariate analyses, current smoking was associated with a significant increase in the risk of SCD (relative risk- 2.47, 95%CI 1.46-4.19). Patients who had stopped smoking had no significant increase in the risk of SCD compared to patients who had never smoked (relative risk - 1.06, 95%CI 0.70-1.61). Kaplan Meier survival curves comparing active smokers, past smokers and never smokers are shown the figure below.



Conclusion: In patients with CHD cigarette smoking elevates the risk of SCD, while smoking cessation results in a significant reduction in SCD rate.

1143-167 The Echo Stethoscope: Is It Ready for Prime Time by Medical Students?

Lori B. Croft, Ben Cohen, Thomas Dorantes, Shilpa Harish, Matthew Stanizi, Eli Portnoy, Anthony Manasia, Eric H. Stern, Martin E. Goldman, *Mt. Sinai Medical Center, New York, New York.*

Background: Hand-held inexpensive ultrasound systems have been developed but have only been utilized by skilled cardiologists or technologists. The maximum benefit of these "echo-stethoscopes" would be to empower all physicians with the skill to perform a "limited" bedside echo by incorporating echo into their physical exam as an echostethoscope; not to replace a formal echo. **Methods:** To determine the feasibility of a practical course to train medical students to perform echo, four first year medical students underwent a two week "hands-on" tutorial to perform and interpret a "limited" echo exam (defined as long, short and apical views, but no Doppler) to assess LV and size and function, and the presence of significant valvular disease or pericardial effusions. **Results:** The students acquired echo's in the emergency ward (119 pts) and intensive care unit (118 studies). The students' echo studies were overread and repeated by an echocardiologist who graded the student's technical and interpretive skills. Of the 237 studies, 160 were done on the Cypress® lap-top system (Acuson/Siemans) and 77 on the Sonosite® hand-held system (Sonosite). The student's echo exam took 8.05 min (± 3.5 min). The students' limited echo was technically diagnostic in 96% and interpreted correctly in 80%. **Conclusions:** Thus, small echo systems enable medical students to perform and accurately interpret limited studies following a brief training. Implications of this study support the feasibility of formally educating medical students to utilize bedside echo-stethoscopes.

1143-168 Cardiac Valve Calcification Is an Important Predictor for Mortality in Renal Failure Patients on Dialysis

Angela Yee-Moon Wang, Mei WANG, Siu Fai LUI, John E. SANDERSON, *Prince of Wales Hospital, Chinese University of Hong Kong, Hong Kong, Hong Kong.*

Background. Cardiac valve calcification (VC) is a frequent complication in dialysis patients. This study aims to determine the impact of VC on the outcome of these patients.
Method. Echocardiography was performed in 191 peritoneal dialysis patients to determine the presence of calcification of the mitral, aortic valve or both. Patients were followed up prospectively for a median duration of 15.4 (range, 2.0-22.9) months. All-cause and cardiovascular mortality were studied in relation to VC.
Results. Mean age: 55 (12) yrs (M:F=97:94). Mean dialysis duration: 39 (31) months. 51 patients (33%) had VC. Mean follow-up duration was 15 (4) vs 16 (4) months (VC vs non-VC). 40 endpoints (33 deaths and 7 transplants) were observed. 50% deaths were cardiovascular causes. 28% (VC) vs 12% (non-VC) died among which 59% (VC) vs 38% (non-VC) group was from cardiovascular causes. Overall 1-year survival was 78% (VC) vs 92% (non-VC) (P=0.004). Mortality due to cardiovascular causes was 15% (VC) vs 4% (non-VC) (P=0.004; log rank test). VC patients had higher all-cause [Hazard ratio (HR) = 2.62, (95% CI: 1.32-5.19); P=0.006] and cardiovascular mortality [HR = 5.71, (95% CI: 2.12-15.37); P=0.001] than non-VC patients. Using stepwise Cox regression analysis, VC remained significantly & independently associated with an increased all-cause and cardiovascular mortality after adjusting for demographic (age, sex, dialysis duration, diabetes, smoking), biochemical (CRP, albumin, calcium x phosphate, parathyroid hormone, cholesterol), blood pressure and atherosclerotic diseases (AVD). Presence of both aortic and mitral VC had a HR of 5.72 (95% CI: 1.43-22.90) (P=0.014) while those with either mitral or aortic VC had a HR of 3.54 (95% CI: 1.19-10.54) (P=0.023) for all-cause mortality than those with no VC. Moreover, all-cause and cardiovascular mortality were significantly higher among patients with both VC and AVD compared to those having either VC or AVD and were in turn higher than those with neither VC nor AVD.
Conclusions. VC is a powerful predictor for mortality and cardiovascular deaths in dialysis patients. Its co-existence with clinical AVD represents more severe atherosclerotic diseases and predicts a worse outcome.

1143-169 Cost Comparison of Radiofrequency Ablation and Antiarrhythmic Therapy of Atrial Flutter

Brahmajee Nallamothu, Frank Pelosi, Jr., Bradley P. Knight, S. Adam Strickberger, Fred Morady, Hakan Oral, *University of Michigan, Ann Arbor, Michigan.*

Purpose: Radiofrequency ablation (RFA) is very effective in treatment of atrial flutter (AFl). However, RFA is associated with procedural costs and low-incidence of potential complications. The purpose of this study was to compare the cost of RFA and antiarrhythmic (AA) therapy in patients with AFl.
Methods: Using a Markov model, the clinical benefits and costs of 2 treatment strategies, RFA and chronic AA therapy with a class IC agent, propafenone, were compared in a hypothetical cohort of men and women at a mean age of 50. The base-case estimates and costs were derived from the literature and 60 consecutive patients who underwent RFA at the University of Michigan (mean age= 58 ± 13). Major assumptions of the model were: 1) an annual AFl event rate of 4 episodes per year; 2) a 60% risk reduction with propafenone; 3) a 10% annual discontinuation rate for propafenone; 4) an annual pro-arrhythmia rate of 0.025% with propafenone; 5) a 90% RFA-success rate for PAF; 6) an RFA-complication rate of 1% and a mortality rate of 0.1%; and 7) a 10% annual AFl recurrence rate after RFA.
Results: Compared to chronic AA, RFA was the dominant strategy in patients with AFl, reducing lifetime arrhythmia-associated costs by $41,000. This result was robust to a wide range of potential values for several key model inputs including the frequency of AFl events and the efficacy, complication rates, and costs of AA therapy and RFA. For instance, RFA remained more effective and less expensive than chronic AA therapy during a sensitivity analysis where we assumed that RFA efficacy was lowered to 75%, its complication and mortality rates were increased to 3% and 0.3%, respectively, and its costs were doubled.
Conclusions: RFA for AFl in patients without structural heart disease is associated with a substantial decrease in lifetime arrhythmia-associated costs when compared to AA therapy.